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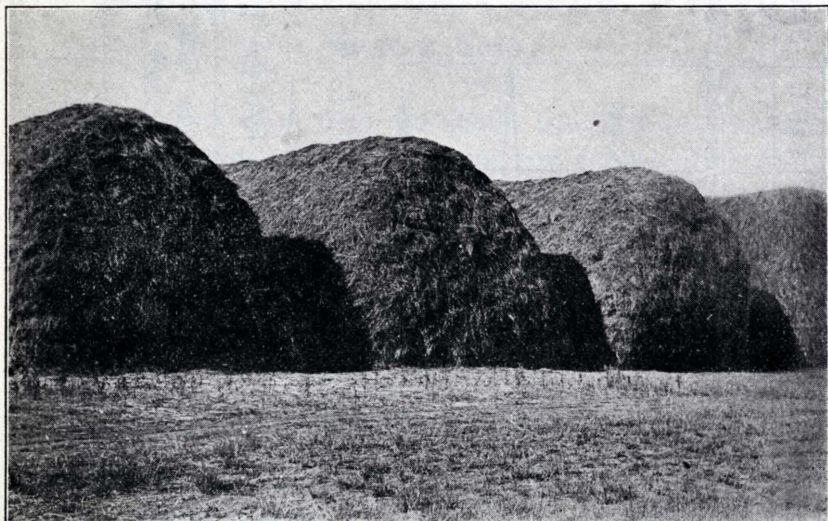
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Utah Agricultural College
EXPERIMENT STATION

Circular No. 10



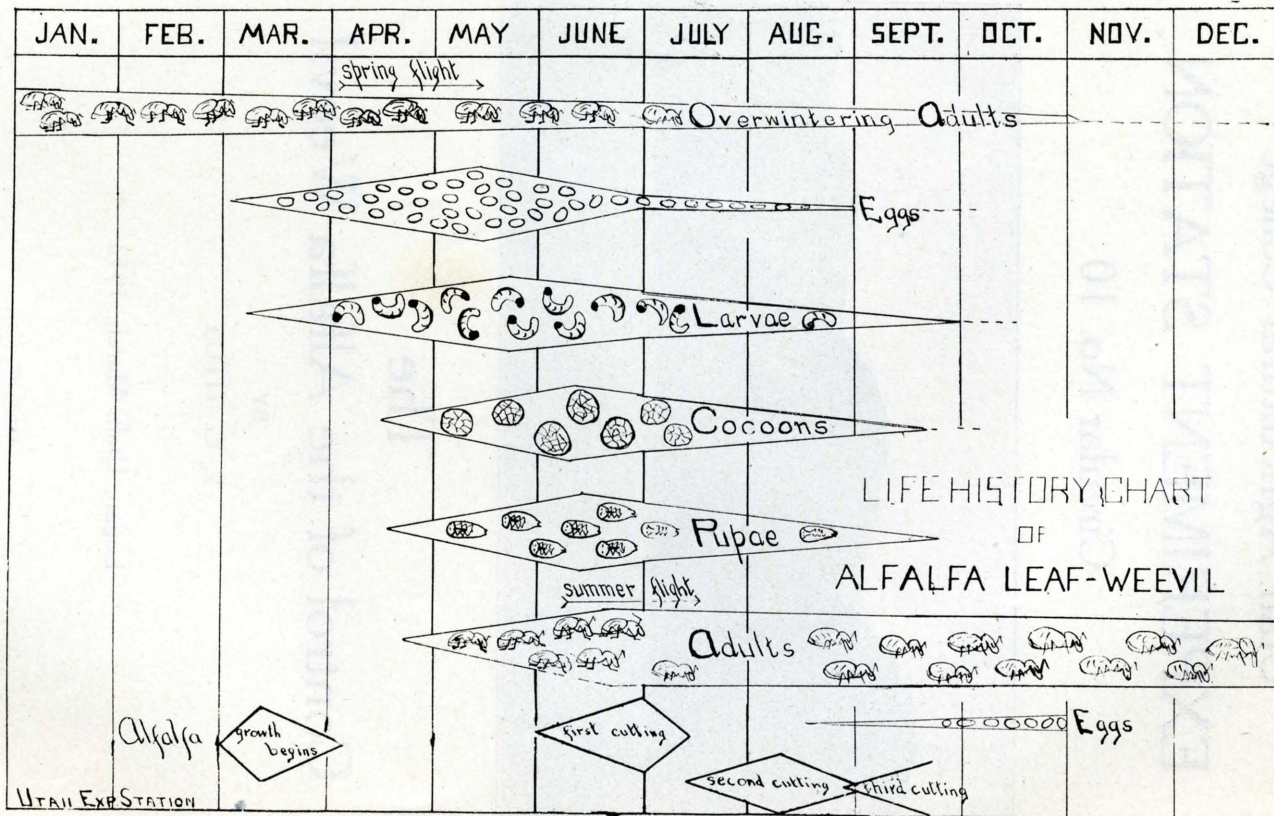
The
Control of the Alfalfa Weevil

BY

E. G. TITUS

Logan, Utah, March, 1913

PRESS OF
THE F. W. GARDINER CO.
SALT LAKE



The Control of the Alfalfa Weevil

By E. G. Titus.

During the work with the alfalfa weevil throughout several very different seasons and in different regions of the State, a number of methods of control have been developed that bid fair to be of service in combating this insect. The prospect for the alfalfa grower in the infested area looks more hopeful each year. It is the purpose of this circular to give a brief account of the alfalfa weevil, its present distribution, and the principal methods that appear to be of value in its control.

DISTRIBUTION.

The alfalfa weevil is an insect well distributed over Europe, West and Southwest Asia, and North Africa.

In 1907 the alfalfa weevil was first reported in Utah. It was found that season injuring alfalfa on the benches east and southeast of Salt Lake City. During the next three years it spread rapidly over the adjoining alfalfa regions, crossing over the mountain ranges and hills surrounding Salt Lake valley, and thus entering Summit, Wasatch and Tooele counties. From the north end of Salt Lake valley it worked its way over fields into Davis county, and from the south end through "The Narrows" into Utah county. Severe damage was caused to alfalfa in this earlier infested territory in 1909, and especially during the dry season of 1910. In fact, the damage was so severe that many farmers plowed up their fields, feeling that it would be impossible to grow a crop of this forage plant under these conditions.

*The field work with reference to control has been carried on in cooperation with the section of Cereal and Forage Insect Investigations, Bureau of Entomology, U. S. Department of Agriculture.

SPREAD 1911-12.

In the years 1911-12 the weevil spread over many miles of territory, both north, south, and southeast, so that its present distribution includes parts of Uinta county, Wyoming; Bear Lake and Oneida counties, Idaho; and in Utah, Box Elder, Cache, Rich, Summit, Wasatch, Sanpete, Millard, Juab and Tooele counties are partly infested. Probably all of the alfalfa growing regions in Weber, Morgan, Davis, Salt Lake and Utah counties are infested. Over only a part of this later infested territory will there be any appreciable damage the coming year. The outskirts of the infested regions will be practically free from injury for at least one or two years.

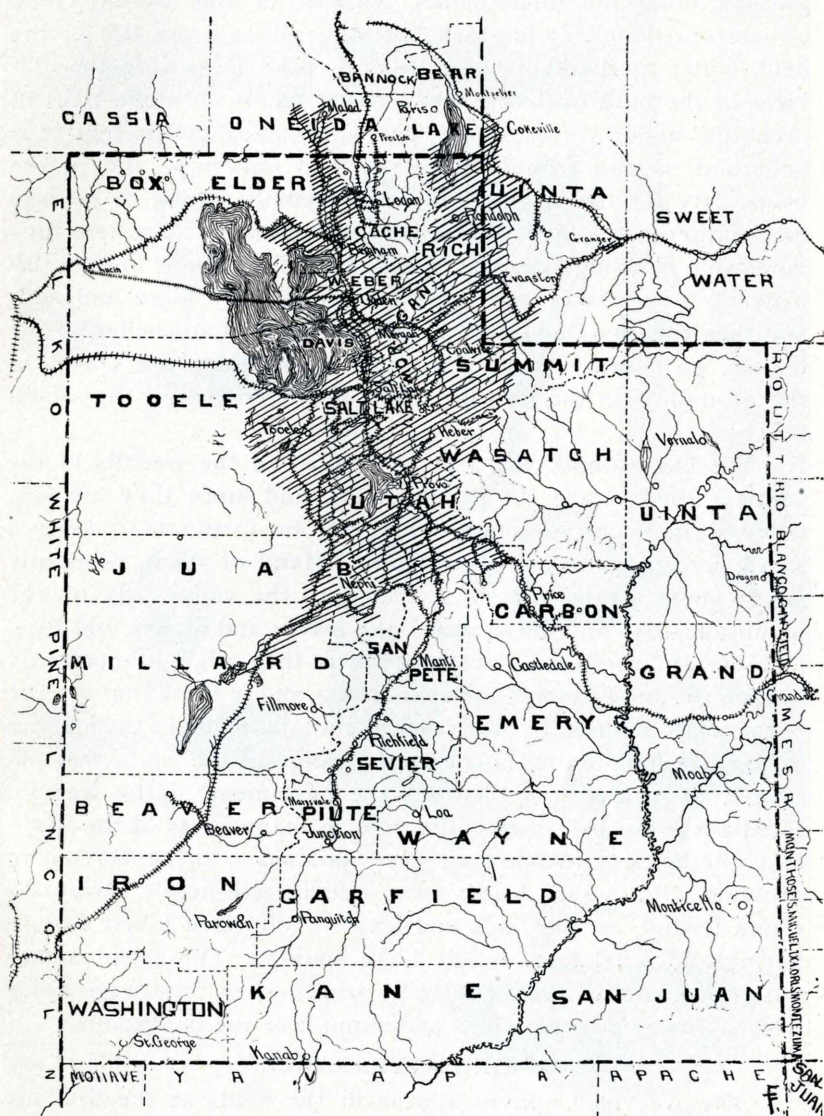
FLIGHT.

The distribution appears to be almost entirely by flight. Although many specimens have been carried out of the infested area by train and by almost every other means of transportation, we have, so far, found no colonies that could be certainly attributed to this cause alone. We know of many parts of the infested areas which were certainly infested by the insect flying into the regions.

Experiments were begun in 1908 to find some satisfactory means of controlling the weevil. Along with this work has been conducted a careful study of the life history and habits of the weevil, and of the native insects, birds, and other animals that are found preying upon the weevil.

LIFE HISTORY.

The weevil passes the winter as an adult insect, having gone into hibernation in late summer and early fall. The time of entering hibernation varies greatly in different years and in different localities. If the summer is long with warm sunshiny weather throughout the latter part of the season, the weevils enter hibernation late and many of them perish before the summer ends. On the other hand, if the late summer is rather cool and cloudy, they will go into hibernation earlier and apparently more of them pass through the winter successfully. In the higher mountain valleys, the weevils become adult later in the summer and enter into hibernation earlier. The place of hibernation is as varied as the regions where it



Map showing known distribution of alfalfa weevil, March 1, 1913.

occurs. Many secure a shelter under dead weeds and dead grasses along the ditch banks, fence rows and around trees. Others crawl under old stack bottoms, piles of hay left in the field, under the bark of fence posts or dead trees, into the crevices of the bark on living trees, under bands on apple trees in orchards, under sticks, stones, and almost any debris that may be found on the ground in and around buildings, and in the fields. By far the larger number of weevils appear to go into hibernation in the fields where they become adult or where they flew after reaching the winged stage. They do not burrow far beneath the surface unless the ground is very loose and soft, and then they may go down as far as three or four inches. They usually go beneath the surface only where there are cracks in the ground or in the firm dirt close to the crowns of the alfalfa plants.

We have found that a large number of the weevils in the summer flight leave the alfalfa fields, and since they are distributed in every direction, they will be fortunate if even a small percentage reach other fields. Many of them, especially where there are mountains surrounding the valleys, fly up the mountain sides and crawl under the leaves and stones, old logs, and into any sheltered place near where they alight. Apparently but few of these emerge the next spring, and of those that emerge but a small percentage ever reach the alfalfa fields in their flight. So far, we have found no mountain range in the State that appeared to in any way obstruct the movement of the weevils. Alfalfa has escaped from cultivation in many parts of the State, and whether it is found on the mountain sides, in the canyons or growing wild in sage brush areas weevils will nearly always be found feeding on the buds and leaves. We have taken weevils as high as 9,500 feet in Salt Lake county. These had apparently been carried there partly by winds when they were flying and had lodged on the sides and summit of the mountains.

SPRING APPEARANCE.

The weevils begin to appear in the fields at the first approach of spring, causing more or less damage by puncturing with their beaks the tender shoots of alfalfa.

EGG LAYING.

A few eggs are deposited on the stems and buds and even dropped on the ground or around the plants. When the warm

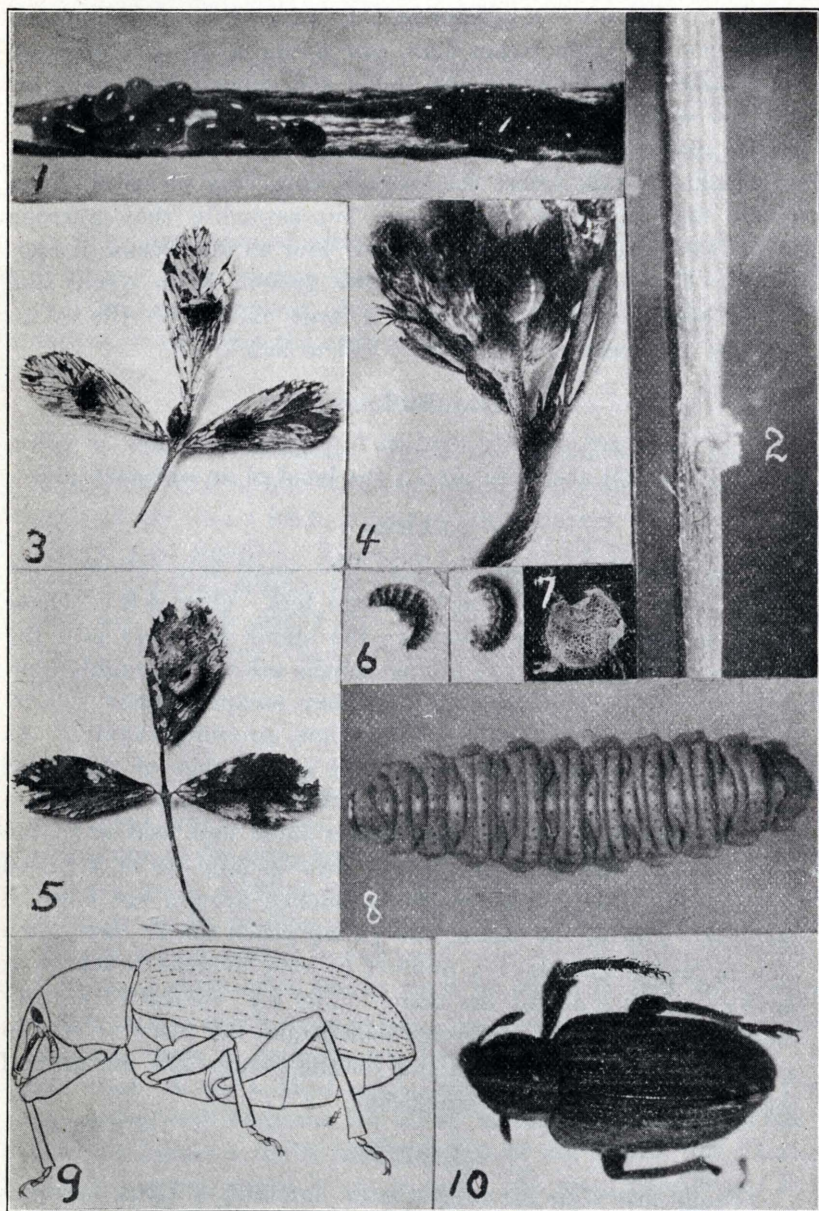


Plate I. Fig. 1. Eggs in open stem (greatly enlarged). Fig. 2. Larva emerging from stem. Fig. 3. Adults feeding on leaf (natural size.) Fig. 4. Larva feeding in bud (enlarged 2x). Fig. 5. Larva (natural size). Fig. 6. Larva (enlarged). Fig. 7. Cocoon. Fig. 8. Dorsal view of larva (enlarged 10x). Figs. 9-10. Adult weevil (enlarged 10x.)

weather continues throughout a large part of the day, and the alfalfa is six or eight inches high, egg laying is begun in earnest; the females now puncture the stems and deposit their eggs inside the stem. From one to forty-five have been taken from a single puncture, while several hundred have been found in a single alfalfa stalk where the weevils were very plentiful. One female may lay over 1,500 eggs, but probably they average about 600 to 800 apiece during their four to six weeks of egg-laying. Eggs laid in the fall on the ground or in weeds and hollow stubble are apparently to a large extent infertile or injured by the weather so that they fail to hatch.

EGG.

The eggs are slightly oval in form, lemon yellow in color, and three would about lie across the head of an ordinary pin.

LARVA

They hatch in about ten days into small pale yellow-green worms, with black heads and without feet. (Fig. 4-6.) These young larvae work their way up the stems and bore into the developing leaf buds. The young worms are so thoroughly concealed in the developing buds that they escape ordinary observation. There they feed for some time, growing rapidly. As they grow their color becomes more nearly that of the plant upon which they are feeding, and since they soon become too large to stay in the buds, they desert them and feed upon the open leaves. While on the leaves they usually lie in a curled position, the rear end of the body hooked around the edge of the leaf. The larvae when full grown reach about one-fourth inch in length and have a number of very evident wrinkles or furrows running across the body. (Fig. 8.) Beneath the body there are some fleshy tubercles which take the place of feet in aiding the worm to move about on the plant. On the ground the larvae are very poor travelers.

COCOON.

From thirty to fifty days after hatching a larva becomes full grown and falls or works its way down the stem of the plant to the ground. The shelter of a fallen leaf or a clump of alfalfa stems serves as a place in which to spin about itself a lace-like network, the cocoon. (Fig. 7.)

PUPA.

Twenty-four to forty-eight hours later, inside the cocoon the larva changes to the pupa or resting stage, and in ten days or two weeks, into the adult insect—the alfalfa-weevil.

ADULT.

The hard shelled weevil (Fig. 10) is about three-sixteenths of an inch long, with a snout or beak on the head. The body is oval in shape, brown, gray-brown or black in color, with a darker stripe down the center of the back.

FOOD PLANTS.

In the intermountain region the alfalfa-weevil feeds primarily on alfalfa, but will live readily on sweet clover. It is more rarely found feeding on the other clovers, peas, beans and several wild legumes. Eggs have been found deposited in many of our grasses, grains, and weeds, but very few of the larvae hatching in such places survive, their slow mode of progression usually preventing them from reaching the necessary food plants.

CONTROL.

The length of the egg-laying period each year naturally has a decided effect on the length of time that appreciable injury will occur to the crop for that year. Warm, dry spring weather appears to be conducive to rapid egg laying, and thus many more larvae are feeding on the alfalfa at any one time than when the egg-laying period is extended over several months. Under these conditions more larvae come to maturity and the damage to the crop is much more severe, since so many worms are present that there is little chance for the plant to recuperate. On the other hand, a slow cold spring and summer means that egg-laying will continue for many weeks, and though probably as many larvae actually feed throughout the season, the damage to the crop harvested is not so great, the plant continually having opportunity to develop new buds and leaves. This readily explains the apparent decrease in injury in infested regions in 1912 as compared with the loss in 1911 in the same sections of the State.

NATURAL CONTROL.

The extreme dryness and hot weather of our summers will to some extent act as a natural control, but will by no means hold the weevil in check, nor appreciably lessen the damage. We do not expect the weevil to disappear in a year or so as do the grasshoppers or army worms after a serious outbreak. The alfalfa-weevil is not a native of this country, and while a number of Utah insects prey upon it, they are species that feed readily upon any insects found in the field. They are not numerous and do not belong to groups of insects that multiply rapidly, and they themselves have enemies. A number of birds, toads and reptiles feed upon the weevil and aid somewhat in its control.

The main issue is how to grow a marketable, profitable crop of alfalfa on territory infested by the weevil.

INJURY.

The principal damage to alfalfa is to the first crop by the feeding of the worms, and later, to the third crop, by its failure owing to the delay in getting a second crop started to grow. Where no work is done after the first crop is removed, the worms will go back to the stubble, which always has some green leaves on it, and feed for some time before they are full grown. There will be so many of them that they will keep the alfalfa from growing for several weeks. Not until the majority of these larvae are full grown and have spun their cocoons will the alfalfa have a chance to grow. This delay usually means that frost will arrive before a third crop can be raised, and in some of the higher mountain valleys even before the second crop is ready to cut.

Our principal efforts have been to find cultural methods which will obviate these two difficulties. Any means of stimulating the growth of the first crop so that it will nearly or quite reach maturity before it has to be cut on account of the injury by the weevil will aid in this work. Fall cultivation of alfalfa-fields appears in some communities to be very useful in getting a large first crop, but we need further data before we can recommend it for State-wide use.

SPRING CULTIVATION.

The difference of a week or ten days in the cutting of the first crop spells success or failure. Thorough disking or spring-

toothling as late in the spring as possible will break up the hard soil, divide the alfalfa crowns and give the plant an opportunity for growth several days earlier than it would receive under ordinary conditions. This will also aid by killing many of the grasshopper eggs and alfalfa-butterfly pupae that are present in the field, thus preventing injury by these insects. **Keep the first crop growing as rapidly as possible.**

PASTURING.

The thorough and rapid clean-up which follows upon turning a large flock of sheep in the field in early spring, allowing them to rapidly eat the weeds, grass and alfalfa off clean, works very satisfactory where animals are available for such purposes. The sheep should not be kept on the fields over three or four days. Early spring pasturing with horses, cattle, or hogs is not advocated.

SECOND CROP.

When the first crop shows signs of serious injury, it should be cut and removed from the field as rapidly as possible. Then go over the field with a spring-tooth harrow or alfalfa cultivator, following this treatment with heavy brush-dragging. If the field is heavily infested with worms, it may pay to cross-drag it. This treatment, if properly carried out, should leave the field with a fine dust mulch over the surface and the alfalfa stems bare, all the leaves being torn off them.

Several benefits accrue from this treatment. The ground is in better condition to carry a second crop and the harrowing and dragging has killed many of the larvae and tender pupae. The larvae that survive the treatment have to crawl through fine dust to reach the stems, and the few that really get to the stems find little upon which to feed. A few hours in the dust or unprotected on the stems by shade gives the hot sun an opportunity to kill many of them. It is well not to irrigate for one or two days in order to allow the sun and dry dust to get the best results. The second crop will now start quickly and grow practically unmolested by the weevil. On land treated by this simple method, the gain has been from 1½ to 3½ tons per acre for the full two cuttings, a result produced at an outside cost of \$1.25 per acre.

BRUSH DRAGS.

There are many forms of brush-drag, and not all of them are successful. A drag made by tying together at the butts a number of pieces of brush (Fig. 11) might as well be kept off the field. There is no means of holding this brush down on the ground where it will do the work intended. In making a **successful brush-drag**, keep the brush as flat as possible. Keep the butts low and let each be separately fastened on top of a plank or pole or pushed through holes bored in the pole. The butts may be nailed, bolted, or wired into place, and another plank laid over the butts and firmly fastened down will aid in making the brush more secure. An ordinary harrow laid on the brushy part of the drag will aid in evenly weighting it and will help to drive the brush into the hollows and crevices and to tear the leaves and stubble. If desirable, a plank or log may be laid across a drag on which the driver can stand, but in any case the brush needs weighting down in some manner. (Fig. 12-13.)

ROTATION.

It does not pay to run alfalfa longer than four or five years in a weevil infested district. Old alfalfa is always more seriously injured. It seems to lack the necessary vitality to put forth the several extra crops of leaves necessary where the worms are numerous. Alfalfa can be readily started even in a severely infested region by planting with a nurse crop.

CLEAN CULTURE.

To destroy the hibernating places as far as possible should be the aim of a careful farmer. This means: clean up the weeds, grass and rubbish along the canals, ditches and fence rows. Destroy old stack bottoms. Do not leave small piles of hay in the field. Burn or plow under the dead vines, weeds, stalks, etc., left in the garden at the close of the season. Do not leave large manure piles or other unnecessary materials around the barns and outbuildings. Cut and remove the alfalfa along the borders of the fields, as well as you do that in the center.

COMMUNITY WORK.

Community work will always give the best results; however, it has been many times proven that any man can raise a good crop in the midst of careless neighbors. A number of farmers

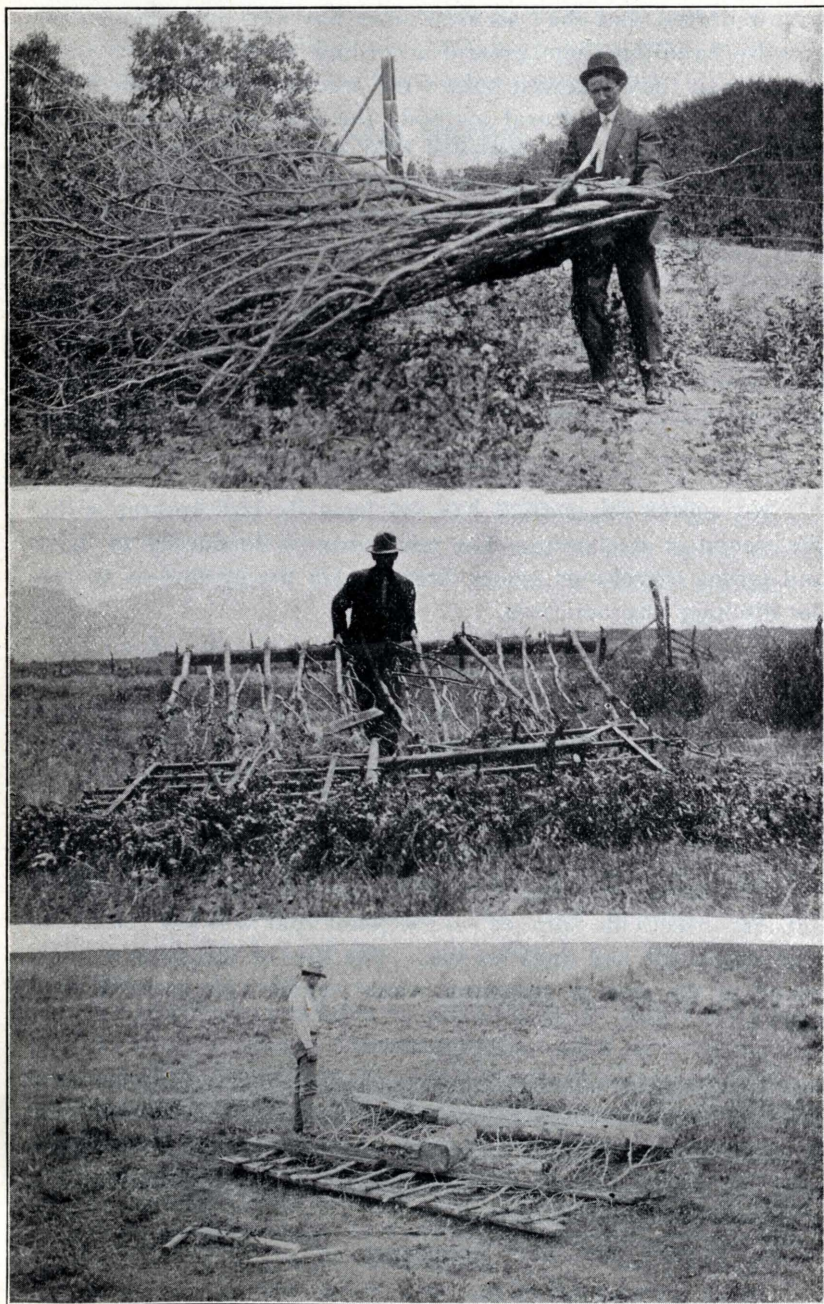


Plate II. Fig. 11. Worthless type of brush drag. Figs. 12-13.
Brush drags properly constructed.

have reported that they secured more hay and more money per acre by handling their ground according to the methods given above than they received before the weevil reached their fields.

Begin to use cultural methods the first year of infestation and keep it up. It is believed that it will be possible to so thoroughly check the multiplication of the insects that good crops will be the rule rather than the exception, regardless of your neighbor's policy.

UNSUCCESSFUL METHODS.

Many experiments have been tried that have proved to be either unsuccessful in controlling the weevil or too costly to be profitable. Among these may be mentioned the following:

TRAPPING.

No successful method has yet been devised to trap either the weevil or its larvae. The adult insects **do not fly to lights** and larvae travel such short distances on the ground as to render ditching impracticable.

COLLECTING.

A successful collecting machine may be built at a reasonable price, but except where no attempt has been made to control the weevil by cultural methods or under unusual conditions of infestation it would not be feasible.

POISONING.

The larvae are readily poisoned with arsenical compounds, but any insecticide sprayed on the plant that will kill the larvae will render the hay unfit for use. The loss of the sprayed crop, added to the cost of spraying, would render this method inadvisable.

STEAMING.

The process of steaming the alfalfa in the spring or after the first crop has been removed has been advocated and tried in some places. Results were not very satisfactory. The price paid for doing this work thoroughly will usually make it a prohibitive method of control.

BURNING.

Rapid burning-off of the land during the egg laying season is of considerable service in growing a second crop. However,

this would not be profitable, since it means the entire loss of the first crop. Burning machines have been tried in the co-operative work, but so far have been unsuccessful.

FALL GRAINS.

The alfalfa weevil does not prosper well in the shade. It has been thought possible to grow with the alfalfa some other crop that would shade it the first six weeks in the spring. Several fall grains have been planted and were fairly successful in protecting the alfalfa. However, the first crop, when cut, cannot be sold as straight alfalfa on account of the straw present in it, and unless the grower expects to feed this crop it will hardly be a profitable method of control.

ACKNOWLEDGMENTS.

It is desirable to here express appreciation of the efficient work done by Mr. V. A. Sadler, assistant in field work, during the seasons 1910 and 1911, and to Mr. H. J. Webb, assistant in 1912.

Thanks are especially due to Mr. Parley Austin of the Utah-Idaho Sugar Company at Lehi, Mr. J. N. Burton at Kaysville, Mr. M. Nelson at Sandy, for their hearty and efficient co-operation in the experimental and demonstration work carried on at their farms during 1911 and 1912.

Among the many other farmers who have aided us in the field work from 1908 until the present year special mention should be made of Mr. L. Hemenway, Mr. M. Gilby and Mr. Thomas Barton, all of Granger; Mr. Earl Bennion and Mr. Heber Bennion of Taylorville, and Mr. J. O. Smith of East Millcreek.

The courtesies extended by the D. & R. G., Salt Lake Route and O. S. L. railroads have materially aided in carrying out these studies. Without their assistance it would have been practically impossible to have accurately determined the distribution of the weevil or to have had opportunity to carry on our field work in such varied localities.

SUMMARY.

The alfalfa weevil is a European insect accidentally introduced into Utah and here feeding principally upon alfalfa.

There is no reason to suppose that the alfalfa weevil, which has now been in the State about ten years, is likely to grow less in numbers.

The adults are a hard-shelled snout beetle, brown or brownish black in color with a darker stripe down the back, about 3-16 inch long, living over winter in sheltered places and in the early spring laying eggs in the alfalfa stems. These eggs hatch into small black-headed yellowish green larvae that feed upon the buds and leaves for about six weeks. When full grown they spin a cocoon on the ground, pass into the resting stage and in about two weeks emerge as adults. There is but one brood a year.

Keep the alfalfa growing rapidly in the spring by disking or spring-toothing.

Remove the first crop as soon as serious injury occurs and spring-tooth and brush-drag the land immediately and thoroughly.

Rotate the alfalfa at least every four or five years.

Clean up all around the farm, especially canals, ditch banks, weed patches, gardens and around the farm buildings.

Careful, thorough, timely work will do much towards securing good results. Do the work on your farm right, and endeavor to persuade your neighbor to use good methods in caring for his alfalfa, but if your neighbors will not care for their alfalfa, take care of yours and the crop will repay you.